ABSTRACTS.

Martin Twin-Engined Bomber.

The general characteristics making this machine stand out from others of its type are its good flying qualities and high efficiency. It is claimed that it is most comfortable to pilot, answering all controls readily with full load and either one or both engines running. With one engine it is easy to climb, to turn, and to land comfortably in a small field. It recovers easily from a tail spin and is very stable, pursuing a steady course for a long period with all controls released, and yet exhibiting no stiffness or dangerous tendencies in gusts.

Its all-round efficiency has been proved in trials, an official speed of 118.5 m.p.h. at the ground with full bombing load having been attained. This has been improved on since. Also with full bombing load it has climbed 10,000 ft. in 15 minutes and reached a service ceiling of 16,000 to 17,000 feet.

As a military machine it is built to fulfil the requirements of—

1. Night bomber. Three Lewis guns, 1,500 lbs. bombs, 1,000 rounds of ammunition, with fuel for half an hour on the ground and six hours' full power at 15,000 ft.
2. Day bomber. Five Lewis guns, 1,000 lbs. bombs.
3. Photography machine. Five Lewis guns and two cameras.
4. Gun machine. Five Lewis guns and a semi-flexible 37 mm. gun.

It is easily adaptable for commercial uses as—

1. Mail machine. A ton can be carried with comfort.
2. Passenger machine. Twelve passengers, in addition to pilot and mechanics, can be carried for 600 miles (non-stop).
3. Aerial map and survey work.

The wing truss is conventional outside each of the engines through the body, the system being of streamlined steel tube. The members are arranged with the view to ease of removal of engine, rigidity and simplicity; hence low weight and resistance. The wing spars are of the usual spruce eye-beam type, but the wing ribs are of a novel type developed experimentally. They have a factor of safety of eight. The wing fittings are all designed to give a factor of safety in excess of six.

The body is the most interesting part in many respects. The pilot is placed on the right-hand side, well up, with a good range of vision, and there is a passage so that the front gunner can go aft to handle the rear lower gun. Behind the pilot are three main fuel tanks, and under the seat a hand-wheel is placed for operating the adjustable stabiliser. The firing platform for the rear gun is situated near the rear spar. The lower gun commands a large field of fire to the rear, below, and to both sides. The body in most other features is a combination of two types, the wire strut truss and the veneer-plated wood truss. The tail skid is braced entirely by the internal body structures at the rear panel points, it is universally pivoted and sprung inside the body to receive landing shocks.

The two 12-cylinder Liberty engines mounted in light girder boxes of veneer, rest on brackets on the four main wing struts, so that engines, radiators, airscrews, and nacelles can be removed intact. Nose radiators are mounted in a very satisfactory manner, and equipped with shutters for regulating temperature. There are cushions of rubber between it and the mountings to absorb shock.

The under-carriage is composed of four 800 × 150 mm. wheels, the flexibility of the mounting gear absorbing all kinds of shocks satisfactorily. The gear is simple, light, and of low resistance.

A single wheel and foot bar control is provided in the pilot's cockpit, with the usual weakness eliminated. There are four equal unbalanced ailerons.

The tail surfaces are of steel and wood. The stabiliser is adjustable from the pilot's seat and has a range of angle of three degrees on both sides of the neutral. The elevator is of one piece, and the two balanced rudders work in synchronism.

In addition to the three fuel tanks in the body, there are two gravity tanks mounted on the upper wing above each engine, all securely braced by many internal bulkheads. All valves are easily controlled by the pilot, and an efficient hand-pump is provided to fill the gravity tanks or engine should the two air driven pumps fail.

Dimensions, etc.

Upper planes (including ailerons): 550 sq. ft. (span 71 ft. 5 in.).
Lower planes (including ailerons): 520 sq. ft. (chord 7 ft. 10 in.).
Four ailerons (each): 32.5 sq. ft. (gap 8 ft. 6 in.).
Two vertical fins (each): 8.8 sq. ft.
Stabiliser (normal setting — 2°): 62.25 sq. ft.
Elevator: 43.20 sq. ft.
Two rudders (each): 16.50 sq. ft.
Overall length: 46 ft.
Overall height: 14 ft. 7 in.
Incidence of wings with airscrew axis: 2°.

(D. W. Douglas, "Aviation," Jan., 1919.)

Future of the Helium Airship.

The article discusses the possibilities of commercial uses for the airship, in particular with helium used as a substitute for hydrogen. Helium is an inert non-inflammable gas having 92 per cent. of the lifting power of hydrogen.

Hitherto the difficulty has been that of production and expense, the largest amount in any container previous to 1918 being 5 cubic feet, the cost of manufacture being anything between 1,500 and 6,000 dollars. A process has, however, been discovered, thanks to Government subsidies, etc., of which an account is given, that will enable the pure gas to be produced at the cost of approximately 100 dollars per 1,000 cubic feet. Accordingly it is claimed that the prospects are considerable.

The importance of the discovery is apparent on consideration of the non-inflammable properties of the gas, all of the danger associated with hydrogen being eliminated. It is also stated that the leakage of helium through gold beaters skin is less than that of hydrogen. (L. d'Orcy, "Aviation," Jan. 1, 1919.)

Balancing Aeroplane Propellers.

A perfectly balanced propeller has its centre of gravity exactly on the centre line of the propeller shaft on which it rotates. In practice, although the propellers are made out of wood, as homogeneous as possible, and the two blades as nearly identical as can be attained, one blade is invariably heavier than the other.

The balancing of the propeller to make the centre of gravity of the propeller coincide with the centre of gravity of the propeller shaft can be done either statically or dynamically. The method of procedure for the static balance only requires simple appliances, but is very tedious and slow to carry out.

The dynamic balance can be done much more quickly, but it requires a rather complicated and expensive balancing machine, and in consequence the static method is in more general use than the dynamic.

The author proceeds to explain a dynamical balancing process built up on the same principles as the statical method, which is such that while the results are

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as exact as those obtained statically, it has the great advantage of being rapid in execution. An additional point is that the apparatus required is as simple as that for the static test.

The propeller is fitted to the horizontal testing axle, which rotates on ball or roller bearings so that it is as frictionless as possible. The bearings are rigidly mounted sufficiently high above the floor level to allow the propeller to rotate freely. If the propeller be left to itself it will, after several vibrations, come to rest with the centre of gravity in its lowest position. The weight which must be added to obtain the true balance can be obtained mathematically by following out a simple system of calculation given by the author, the data for which is gained from the results obtained by fixing known weights both above and below the propeller centre, at different given distances.

The article is concluded by some hints on errors to be avoided in making the tests, such as ensuring that the testing axle has no bend in it through the weight of the propeller, that the propeller does not slip on the axle, and that the bearings on which it runs are perfectly rigid. (Baudisch, "Der Motorwagen," Dec. 20, 1918.)

Aircraft Service for Berlin.

The firm of Schütte-Lanz has been granted permission to establish a service for passengers and goods by aircraft between Berlin and all parts of Germany. Until the traffic develops the charges include the cost of the return journey empty. ("Zeitung des Vereins Deutscher Eisenbahnverwaltungen," Dec. 11, 1918.)

Gallaudet D.4 Light Bomber Seaplane.

This machine has been adopted by the U.S. Navy Department for light bombing operations. It is a biplane having a fuselage of streamline form, large central float (no tail float), and two wing floats.

The unique feature of the machine is that the single airscrew, which is of the "pusher" type, is employed in combination with an enclosed fuselage of the tractor type. The fuselage is of circular section at the forward end, where the gunner's cockpit is located. A flexible scarf ring for mounting twin Lewis guns is placed around the cockpit. Immediately behind the gunner's cockpit is the pilot's cockpit, which is just forward of the main planes.

The engine, a 400 h.p. Liberty "Twelve," is located aft of the pilot and between the planes. It drives a ring, surrounding the fuselage, to which the four blades of the airscrew are attached.

The planes have no dihedral angle, but extra vertical fin area is obtained by partially covering in the space between the outer front and rear interplane struts. The planes are similar in plan with ailerons on upper plane only. There is a moderate stagger and pronounced sweep back. The general specifications of the machine are as follow:—

Span	46 ft. 6 in.
Chord, both planes	7 ft.
Gap between planes	7 ft.
Total wing area	612 sq. ft.
Weight empty	3,800 lbs.
Weight of useful load	1,600 ,,
Weight fully loaded	5,400 ,,
Maximum speed	126 m.p.h.
Slowest landing speed	42.6 m.p.h.
Climb in two minutes	2,100 ft.
Flying radius at full power	3 hours.

The useful load is made up of the following:—

Water	115 lbs.
Pilot and observer	350 ,,
Fuel and oil	650 ,,
Ordnance	95 ,,
Bombs	390 ,,
Total	1,600 lbs.

The centre section of the upper plane contains a 38-gallon fuel tank with a supply pipe running straight down to the engine below it. A 75-gallon fuel tank is placed in the main float below the centre of gravity. The fuel system employs twin windmill pumps with overflow return.

Two radiators are located in the centre sections on either side of the gravity fuel tank. They are set into and conform to the outline of the wing section.

The framework of the fuselage is of steel tubing. The main float, which has one step, is of mahogany and has 16 watertight compartments. The two wing tip floats each have five compartments.

Throughout the entire construction, fittings are of aluminium bronze, which makes them proof against corrosion. Struts and spars are of steel tubing. (" Aerial Age Weekly," December 30, 1918.)

Martin K.III Single Seater.

This machine designed as an altitude fighter is equipped with oxygen tanks behind the pilot's seat, and has full provision for electrically heating the pilot's clothing. The seat is so located that excellent vision is obtained. The machine can light down upon and start from a country road, while on one gallon of gasoline it can travel 22 miles. For the transport of mail and small parcels in rural delivery, it is extremely economical. The cost of maintenance and operation is estimated as only slightly greater than for a Ford automobile, while the work is done ten times faster. The main planes are unstaggered, there is no dihedral, the aerofoil section being that known as Openstein I, At 40 m.p.h. this wing section has an L/D ratio of 22.

The principal dimensions and weights are given in the following table:—

Dimensions.	ft.	in.
Span, upper plane (without ailerons)	15	0
Span, lower plane	17	11¼
Chord, both planes	3	6
Gap between planes	4	6
Length overall	13	3½
Height overall	7	4¼
Weights.	lbs.	
Engine	85.50	
Wings	60.75	
Fuselage, complete	106.50	
Propeller and hub	13.62	
Total weight	350.00	

The fuselage is designed to stand a load of 105 lbs. per sq. ft. of horizontal tail. Rubber covering between stabiliser and elevators closes the gap between the surfaces. There is no fin and the rudder which contains the tail skid is provided with balanced areas both above and below the fuselage.

Engine Group.—The power plant consists of an air-cooled two-cylinder opposed " Gnat " A.B.C. engine, developing 45 h.p. at 1,950 r.p.m.

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Fuel consumption, 0.56 lbs. per h.p. per hour; weight, 50.4 lbs. Oil consumption, 0.017 lbs. per h.p. per hour; weight, 1.55 lbs.

The fuel tank is located in the upper main plane above the fuselage. It has a capacity of 9.03 gallons, sufficient for a flight of two hours.

Its performance and endurance is given as under:—

Altitude (ft.).	Time (mins.).	Speed (m.p.h.).
0	0	135
5,000	3	113
10,000	6	112
15,000	11	111
20,000	18	108
25,000	28	97

(With 60 h.p., 100 lbs. engine—speed 145 m.p.h. at 10,000 ft.)

Endurance at 10,000 ft.:—

At full power ... ... 222 miles.
At minimum power ... ... 216 miles.

("Aerial Age Weekly," December 23, 1919.)

EDUCATIONAL.

Lectures on Aeronautics during the Summer Session, 1918.

The distribution of lectures on Aeronautics at the various colleges is very similar to that of the Winter Session. There is a slight increase in number, although a few lecturers have retired. The following subjects have been included in the syllabus: Meteorology, which is so important for all airmen. Aero- and Hydrodynamics, which occupy such a large place in the theory of aircraft, and Wireless Telegraphy, which is being increasingly used on aircraft. In taking up these subjects, it was stipulated that they should also be treated in these lectures in their relations to aeronautics, even when this is not mentioned in the title. When, for example, Professor Mosler (Brunswick) lectures on wireless telegraphy, stations on airships and aeroplanes will also be included.

College.	Name of Lecturer.	Title of Lecture.	No. of Hours.
Berlin	Hellmann	Theoretical Meteorology	1
		Meteorological Conference	1
	Hergesell	An investigation of air in connection with science and aviation	2
	Less	Practical science of weather and climatic conditions	1
		On the atmospheric conditions then present	1
	Marcuse	Geography, taking bearings in travelling by land, sea or air with demonstrations	1½
	Neesen	Atmospheric electricity, lightning conductors	2
	Seeliger	Rudiments of hydrodynamics	1
Breslau	Schaefer	Mechanics of space (electricity, hydrodynamics)	5
		Demonstrations in the mechanics of space	1½
Giesien	Fromme	Meteorology	1
Göttingen	Wiechert	Meteorology	4
Heidelberg	Wolf	Elements of meteorology	2
Munich	Ewald	General view of mechanics, including hydrodynamics, etc.	3
	Schmauss	General meteorology and science of climatic conditions	4

COLLEGE.	NAME OF LECTURER.	TITLE OF LECTURE.	NO. OF HOURS.
Prague ...	Spitaler ...	Weather forecasts	2
		Practical demonstrations in weather forecasting	1
Vienna ...	Exner ...	Meteorology and science of climatic conditions	3
	Schmidt ...	Selection from the dynamics of the air and water enveloping the earth ...	1
Basle ...	Knapp ...	Meteorology	1
Berne ...	Luterbacher ...	Meteorology	1

B. TECHNICAL COLLEGES.

COLLEGE.	NAME OF LECTURER.	TITLE OF LECTURE.	NO. OF HOURS.
Aix-la-Chapelle	Kármán ...	Technical aerodynamics of flight... ...	2
	Polis	Meteorological science	1
Brunswick ...	Mosler ...	Wireless telegraphy	2
		Practical demonstrations in radio-telegraphy	3
	Schlink ...	Technical Mechanics III. (hydraulics, aerostatics and aerodynamics)	4
		Demonstration and repetition for the same	2
		Meteorology and aeronautics	1
Breslau ...	V. D. Born...	Theory of the aeroplane	2
		Demonstrations in aeronautics and meteorology	2
		Rudiments of meteorology	
Charlottenburg (1)	Becker ...	Airship and aeroplane engines	2
	Berndt ...	Electricity in the air	1
	Everling ...	Mechanics of free and captive balloons ...	1
	Dietziers ...	The construction and flying of an airship	1
	Kassner ...	The wind—its arising, measurement and application to the construction of tall buildings and harbours, navigation by sea or air as well as for the construction of wind engines	1
	V. Parseval...	Aircraft	2
	Romberg ...	Aero engines	2
		Sketches of internal combustion engines for ships and aero engines	4
	Schaffan ...	Experiments made with air and water propellers	1
Danzig ...	Föttinger ...	Selections from the physics of technical phenomena of currents	1
		Propellers for aeroplanes and hydroplanes	2
		Designing of propellers for aeroplanes and hydroplanes	2
	Rieppel ...	Engines for land, sea and aerial transport	2
		Demonstrations in the same	3
Darmstadt ...	Eberhardt ...	Airships in flight	2
		Science of flight	2
		Demonstrations in airscrews	6
		General lectures on flight	2
	Henneberg ...	Hydrodynamics	
	Schleiermaden	Aerodynamics in connection with flight ...	2
	Wirtz ...	Practical demonstration in radio-telegraphy	2

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COLLEGE.	NAME OF LECTURER.	TITLE OF LECTURE.	NO. OF HOURS.
Dresden ...	Travelius ...	Introduction to meteorology	1
Hanover ...	Leithäuser ...	Electric waves and wireless telegraphy...	2
	Precht ...	Airships in flight	2
	Pröll	Aero-mechanics applied to engine-driven airships and aeroplanes	1
		Demonstrations in the same	1
Munich ...	Diekmann ...	Wireless telegraphy	2
		The electric and magnetic problems of flight	1
	Emden ...	Aerodynamics and the application of the same to the technical problems of flight	3
Stuttgart ...	A Baumann...	Aeroplanes and details of their construction	2
		Engines for land, sea and aerial transport	2
	Hermann ...	Wireless telegraphy	2
		Demonstrations in the same	4
	V. Koch ...	Meteorology (selections)	1
		Aerostatics and aerodynamics	2
Brünn ...	Szarvassi ...	Meteorology and science of climatic conditions	3
Graz	Wittenbauer...	Technical Mechanics II. (hydrostatics, hydraulics, mechanics of gases) ...	
		Airships and aeroplanes in flight ...	3
Prague ...	Pöschl ...	Hydromechanics (hydrostatics, hydrodynamics)	3
		Demonstrations in the same	1
	Spitaler ...	Meteorology and science of climatic conditions	3
		Practical demonstration of meteorology...	1
Vienna ...	Knoller ...	The airship in flight and the nature of engines	3
Zürich ...	Korda ...	Wireless telegraphy	1
	Wiesinger ...	Construction of engines (2)	3

C. Agricultural Colleges.

Berlin ...	Hess	Demonstrations in meteorology ...	1
		Practical meteorology and science of climatic conditions	1

D. Commercial Colleges.

Berlin ...	Mercuse ...	Geography, taking bearings on land, sea or in the air, with a demonstration at the astronomical observation station of the commercial college	1

(1) In addition Prof. Franke and Priv. Doz. Fassbender-Kock will give nine lectures, demonstrations and practical demonstrations in wireless telegraphy. See syllabus of lectures.

(2) Is a continuation of the lecture on Aircraft given in the Winter Session.

(" Deutscher Luftfahrer Zeitschrift," May 22, 1918.)